PATENT SPECIFICATION

Application Date: Dec. 31, 1923. No. 32,613/23. 231,573

Complete Accepted: March 31, 1925.

COMPLETE SPECIFICATION.

Improvements in Lapping Machines.

We, JOSEPH NEWELL BETHEL, a citizen of the United States of America, and SYDNEY PLAYER, a subject of the King of Great Britain and Ireland, a copartnership trading as Bethel Player Company, located at Westboro, County of Worcester, State of Massachusetts, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement :—

This invention relates to a machine particularly designed for lapping piston rings or other similar flat work.

Lapping machines have been proposed in which the work pieces or articles to be lapped were held in apertures in a work holding plate positioned between upper and lower laps, one of which was rotated, and the work holding plate was rotated about the axes of the laps and at the same time was rotated about its own axis which was spaced from the axes of the laps.

Lapping machines have also been proposed in which the work holding plate positioned between upper and lower fixed laps was centrally mounted upon a rotatable shaft mounted eccentrically in a rotatable sleeve which was itself eccentrically mounted within a second rotatable sleeve, the arrangement being such that the work holding plate was rotated with the shaft as its axis, while at the same time the axis of the shaft was caused by the relative movement of the eccentric sleeves to take a circular course about a movable axis.

The object of the present invention is to provide an improved form of lapping machine in which the work will be moved between the laps in a particularly effective manner, somewhat resembling the movement of the work in hand lapping.

The invention consists in a lapping machine having upper and lower laps between which a work holding plate is arranged, and in which means are provided rotatable about the axes of the laps, and also movable transversely back and forth across the axes of the laps between extreme positions located at opposite sides of said axes, said means being connected with the work holding plate so that the latter partakes of the rotary and transverse movements of said means.

The invention also consists in that the transverse back and forth movements of said means in successive rotations thereof occur at progressively different points in the rotation of said means.

The invention further consists in that a rotatable member and a fixed gear are arranged coaxially with the laps and said rotatable member carries a pinion which engages said fixed gear during the rotation of said member and which carries a crank pin arranged to engage and oscillate an arm mounted upon a shaft carried by said rotatable member parallel with the lap axes, the means connected with the work holding plate being secured to the upper end of said shaft so as to oscillate therewith back and forth across the lap axes.

Other subsidiary features of the invention will be set forth in the appended claims.

A preferred form of the invention is shown in the drawings, in which

Fig. 1 is a sectional side elevation of portions of the improved lapping machine, the section being taken substantially along the line 1—1 in Fig. 2 ;

Fig. 2 is a sectional plan view taken along the line 2—2 in Fig. 1 ;

Fig. 3 is a detail sectional elevation along the line 3—3 in Fig. 2, and

Fig. 4 is a detail sectional plan view taken along the line 4—4 in Fig. 1.

Referring to the drawings, a lapping machine is shown having a base or frame 10, a lower lap 11, and an upper lap 12 supported by an arm, not shown, mounted on a post 13 secured to the base 10, the

[Price 1/-]

laps commonly being made of cast iron. The manner of supporting and vertically adjusting the upper lap 12 forms no part of the present invention and is fully disclosed in Specification No. 216,684, to which reference is made for a more complete disclosure of this portion of the machine.

A shaft 14 is fixed in vertical position in the base 10 and forms a bearing for a rotatable casting or member 15. This casting comprises upper and lower parts (Fig. 1) having integral connecting portions 15a at each side of a central recess, as shown in section in Fig. 4. A worm gear 16 is fixed to the member 15 and is continuously rotated by a worm 17, on a shaft 18 supported in bearings 19 in the base 10 and driven by a pulley 20.

A gear 21 is mounted in the opening between the upper and lower parts of the member 15 and is keyed to the fixed shaft 14. A short vertical shaft 22 is mounted in bearings in the member 15 parallel to the shaft 14 and is provided with a pinion 23 meshing with the fixed gear 21. As the member 15 is revolved above the shaft 14, the pinion 23 is thus given a planetary motion, revolving about the center of the shaft 15 and also revolving at the same time about its own axis.

A crank pin 24 (Fig. 3) is mounted in the lower face of the pinion 23 and extends through a slot in an arm 25 secured to the lower end of a second short vertical shaft 26 (Fig. 1). The shaft 26 is also mounted in the member 15 parallel to the shafts 14 and 22. A plate 27 is fixed to the upper end of the shaft 26 and when in mid position preferably extends diametrically across the axis of the shaft 14. The plate 27 is provided with a guide way 28 for a sliding block 29, which is slotted to receive bolts 30 by which it may be adjusted in any desired position on the plate 27, in order to vary the position of the studs 31 on the plate with respect to the axes of the laps, to thereby position the axis of the plate co-axially with the axes of the laps or eccentric with respect to the lap axes.

Studs 31 extend upward from the block 29 through openings 32 in a work holding plate 33. Pieces of work W are inserted in the openings in the plate 33 and receive movement with the plate 33 between the non-rotatable lower and upper laps 11 and 12. The lower lap 11 is preferably supported upon brackets 34 fixed to the frame 10, one of which is shown in Fig. 1, and the upper lap 12 is non-rotatably supported as fully described in the prior application.

Having described the details of construction of the improved lapping machine, the method of operation is as follows:

The piston rings or other flat work are placed in the pockets or openings in the work holding plate 33 which rests upon the lower lap 11 and which is laterally positioned by the studs 31 in the sliding block 29. After the work is thus positioned, the upper lap 12 is lowered to engage the work, and the belt is then shifted to rotate the pulley 20, the shaft 18, and the worm 17 mounted thereon, by which means the worm gear 16 and rotatable member 15 are continuously rotated.

Such rotation swings the shaft 22 in a circular path about the axis of the shaft 14, and also rotates the shaft 22 upon its own axis, carrying the crank pin 24 with it. The crank pin 24 by its rotation oscillates the crank arm 25, the shaft 26, and the guide plate 27 fixed to the upper end thereof. The plate 27 and block 29 are oscillated between the extreme positions indicated by broken lines in Fig. 2, while at the same time the plate and block rotate with the member 15 and carry with them the work plate 33. The plate 33 thus receives a rotary movement through the studs 31 and is also simultaneously oscillated by the action of the crank pin 24. The rotary movement will be an eccentric rotary movement when the studs 31 are adjusted so that the axis of the plate is eccentric with respect to the lap axes.

The teeth of the gears 21 and 23 are preferably selected so that the teeth of the pinion do not constitute an even factor of the teeth of the gear and consequently the oscillating movements of the plate and block do not occur at fixed points in the rotation of the member 15 but change progressively with each revolution of the member.

The path of movement of a point in the work holding plate is indicated by the broken line B in Fig. 2, the point progressing in the direction of the arrow *a* in a somewhat irregular orbit and completing each revolution at a point slightly removed from its place of beginning. The path of movement of the axis of the crank pin 24 for the same period is indicated by the broken line C on Fig. 2. It thus appears that the work is moved in a somewhat irregular path between the surfaces of the two fixed laps and that this movement is progressively advanced with relation to the laps so that the entire lapping surface of both upper and lower laps is engaged by the work as the lapping operation continues.

As the plate 27 oscillates it will at times be moving in the same direction

as the member 15, thus increasing the speed of the work relative to the fixed laps and at other times it will be moving in a direction opposed to the rotation of the member 15, thus reducing the relative speed to the difference between the two movements. In this way the rate of movement of the work between the laps is constantly varied through a considerable range, as is also the locus of movement between the laps. This combination of the rotary movement, eccentric with respect to the axis of the laps and oscillating movement has been found in practice to be extremely satisfactory and to produce an accurate lapped surface in a relatively short period of time.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is :—

1. A lapping machine having upper and lower laps between which a work holding plate is arranged, and in which means are provided rotatable about the axes of the laps, and also movable transversely back and forth across the axes of the laps between extreme positions located at opposite sides of said axes, said means being connected with the work holding plate so that the latter partakes of the rotary and transverse movements of said means.

2. A lapping machine as claimed in Claim 1, wherein the transverse back and forth movements of said means in successive rotations thereof occur at progressively different points in the rotation of said means.

3. A lapping machine as claimed in Claim 1 or 2, wherein means are provided for effecting the rotation of the means connected with the work holding plate, and additional means are provided for effecting the transverse back and forth movements of said means.

4. A lapping machine is claimed in Claim 1, 2 or 3, wherein the means connected with the work holding plate is oscillated back and forth across the axes of the laps about an axis arranged at a distance from the lap axes and which axis traverses a circular path about the axes of the laps.

5. A lapping machine as claimed in Claim 4, wherein the period of oscillation of the means connected with the work holding plate is different from the period of rotation of said means.

6. A lapping machine as claimed in Claim 4, wherein the points of extreme oscillation of the means connected with the work holding plate occur at progressively different points in the rotation of said means at successive revolutions thereof.

7. A lapping machine as claimed in any of the preceding claims, wherein the rotatable and transversely movable means is connected with the work holding plate by an adjustable connection whereby the axis of the plate may be positioned coaxially with the axes of the laps or eccentric with respect to the lap axes.

8. A lapping machine as claimed in Claim 4, wherein a rotatable member and a fixed gear are arranged coaxially with the laps and said rotatable member carries a pinion which engages said fixed gear during the rotation of said member and which carries a crank pin arranged to engage and oscillate an arm mounted upon a shaft carried by said rotatable member parallel with the lap axes, the means connected with the work holding plate being secured to the upper end of said shaft so as to oscillate therewith back and forth across the lap axes.

9. A lapping machine as claimed in Claim 8, wherein said means comprises a guide plate extending transversely from said shaft and having slidably adjustable thereon a driving block which is connected with the work holding plate, as by means of upwardly extending pins passing through apertures in said plate.

10. A lapping machine constructed and arranged substantially as hereinbefore described with reference to the accompanying drawings.

Dated this 31st day of December, 1923.

MARKS & CLERK.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1925.

[This Drawing is a reproduction of the Original on a reduced scale]

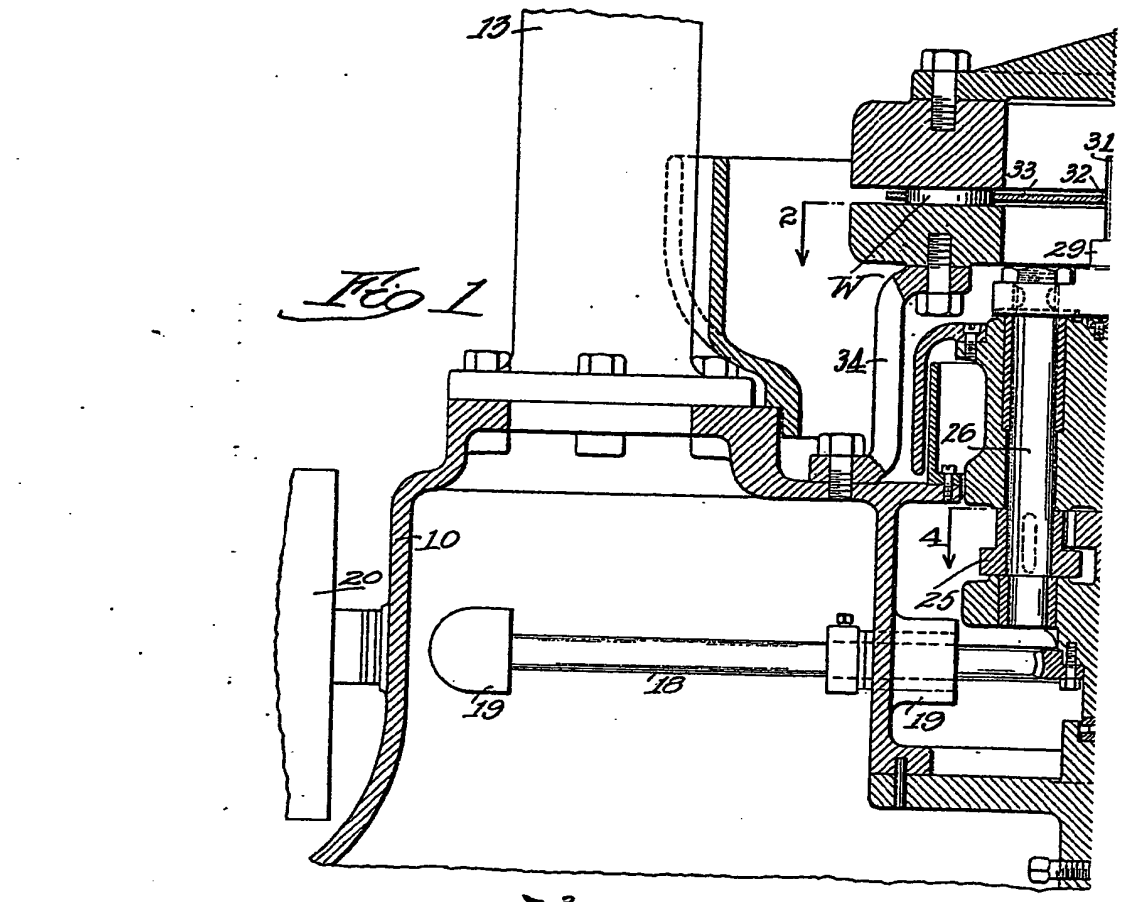


FIG. 1

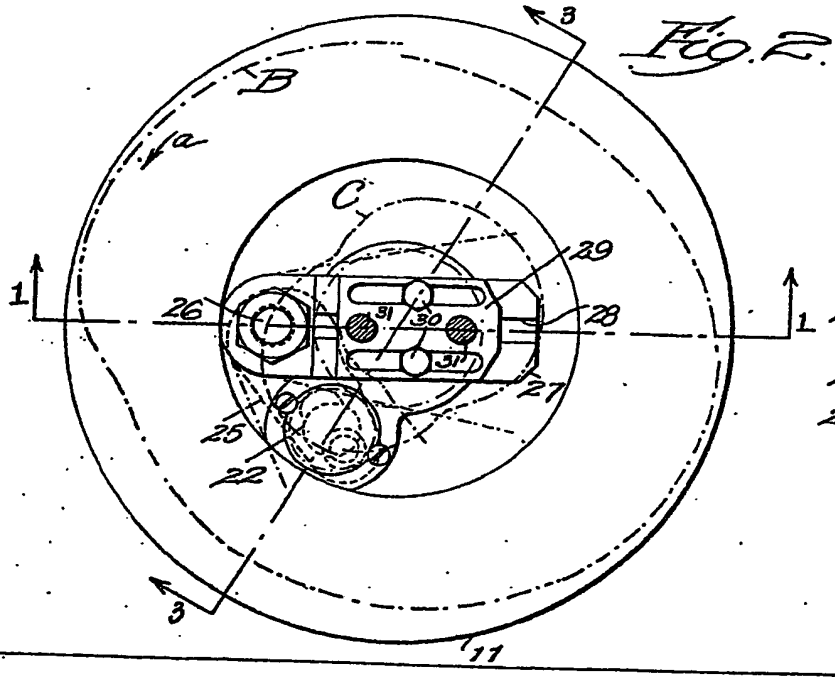


FIG. 2.

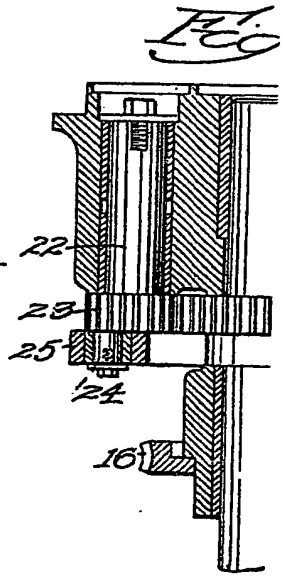


FIG.

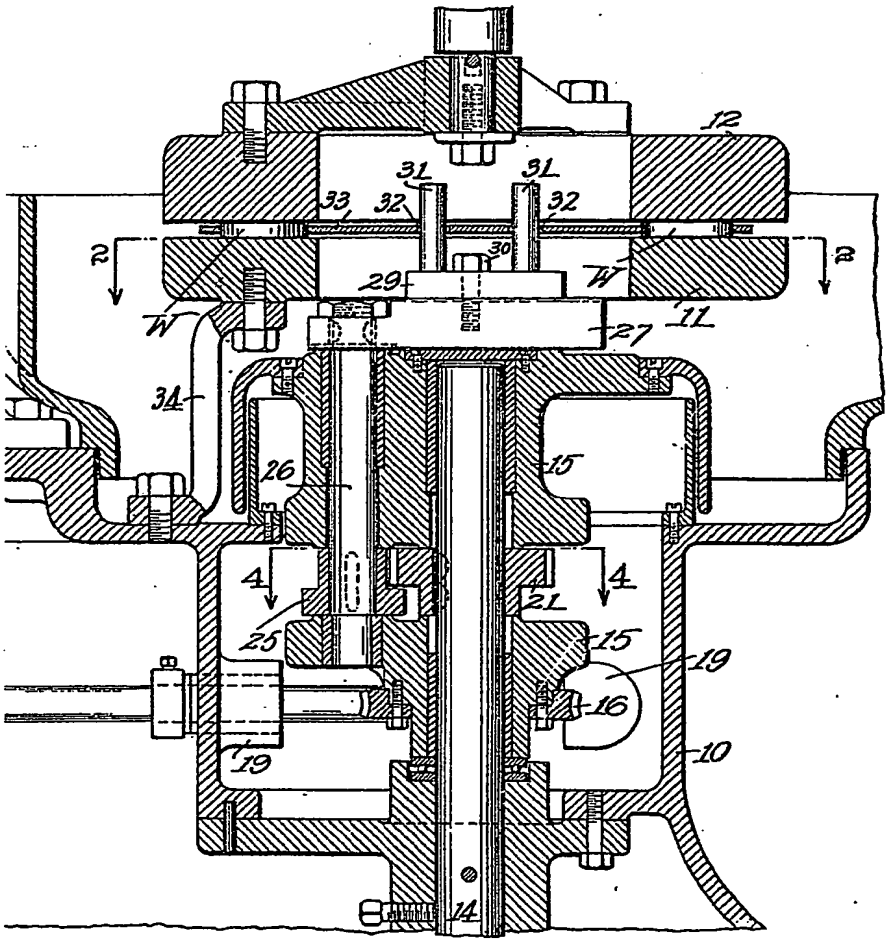


FIG. 2.

FIG. 3

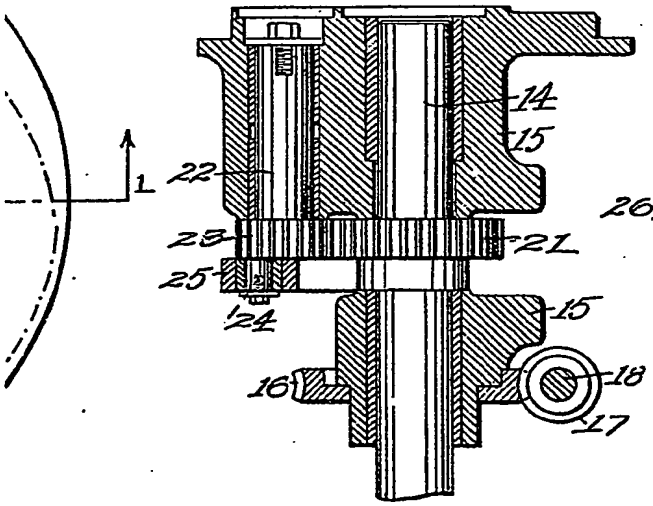
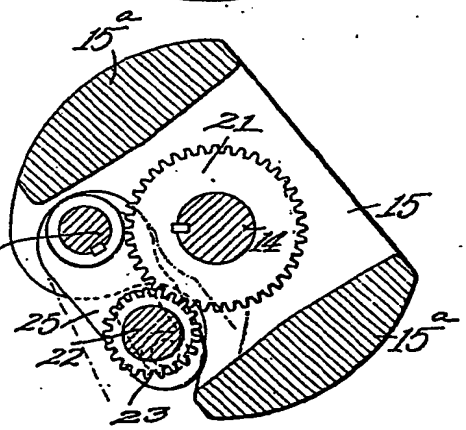


FIG. 4



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[This Drawing is a reproduction of the Original on a reduced scale]

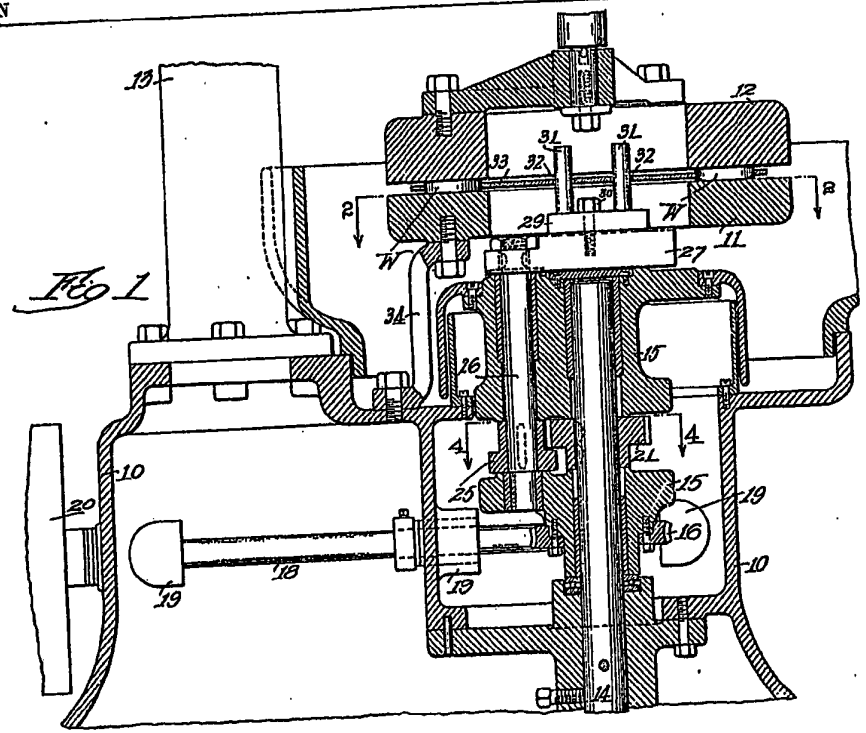

Fig. 1

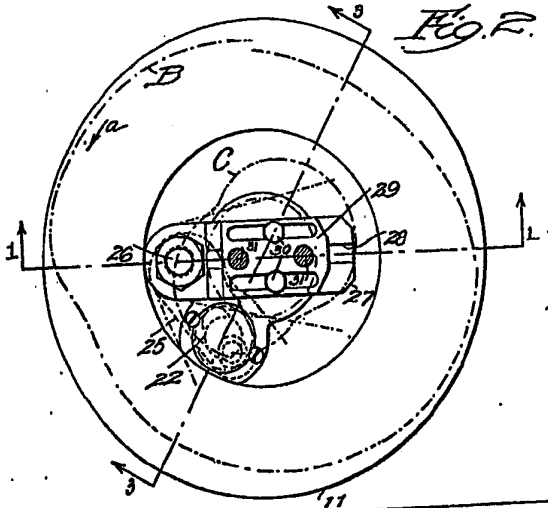

Fig. 2.

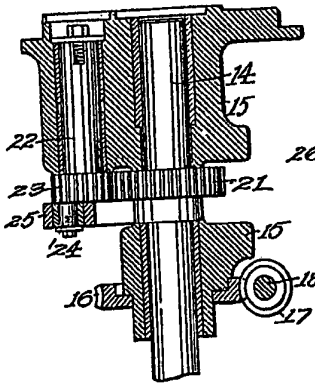

Fig. 3

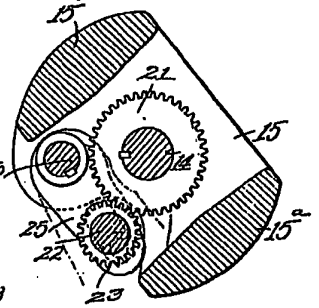

Fig. 4

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